UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

26

EXPERIMENTS CONDUCTED FOR THE PURPOSE OF DEVELOPING A MORE EFFICIENT NOZZLE FOR USE IN CONNECTION WITH THE BURNING-STANDING METHOD OF CONTROL

1931

By
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For the purpose of developing an efficient nozzle for use in connection with the burning-standing method of control, experiments were conducted at this station in the fall of 1929 and a nozzle secured which gave very good satisfaction during the 1930 season. However, as the tests at that time were all made with water, it was hoped that by using an oil, similar to that used in the actual treating of trees, a more efficient piece of equipment could be developed. With that idea in mind, another series of tests have just been conducted by Mr. T. T. Terrell, and it is the purpose of this memorandum to present the results secured.

Any nozzle used in connection with the burning-standing method of control must necessarily have a small bore, if the wasting of oil from splashing is to be prevented. Though the original cost of this fuel oil is not high, when all transportation charges are added, by the time it reaches the burning crews it has become rather expensive. Therefore, an effort was made to secure a nozzle which would throw the oil to a maximum height and still have a bore sufficiently small to reduce the loss from splashing to a minimum. Ten nozzles of different types were constructed with inside diameters varying from .0528 to .0855 inches. Although the nozzles with the larger aperture delivered too large a gallonage to be practical, they were used in an attempt to establish some sort of correlation between different sized bores and variable pressures. The gallonage

delivered per minute was considered as being a rather fair indication of the oil that would be wasted from splashing.

The tables and pictures attached to this report show the types of nozzles, their diameters, the gallons of oil delivered per minute, and the height to which the oil was thrown at different pump pressures. The pictures also show, in black outline drawings, the type of bore for each nozzle.

Nozzle #I was developed in the fall of 1929, and as stated, used rather satisfactorily during the 1930 season. Nozzles IV, IVA, and V, were the same type as #I, but were redrilled for the purposes of this experiment. Number IV was changed twice and after the second change was listed as IVA. Nozzles II, III, VI, VII, VIII, and IX were constructed from sections of brass bushing wire, drilled out to the desired size, and soldered to an ordinary spray nozzle. The bore of #II is slightly tapered as shown by the photograph. All of the other nozzles constructed of bushing wire are of straight bore for the length of the wire.

The height tests were conducted in the open, with no wind sufficiently strong to break or deflect the stream. It would seem well to mention at this time that a very slight breeze materially reduces the height of the stream. A wind of 1 to 3 miles per hour will reduce the height of the stream from 1 to 2 feet. An insect-infested yellow pine tree was marked in feet intervals and used to record the height to which the oil was thrown at each pressure used. Though all measurements were taken from the ground, the nozzles were held at a height of 6'6", which seemed to be a normal position.

A Smith Banner Pump, equipped with a pressure gage was used in making the height test. This equipment is the same as used for actual treating of trees, and consists of a 4 gallon tank with a built-in air pump. For the tests of gallonages delivered per minute, a wheelbarrow spray pump capable of maintaining an even pressure for a long period, was used. To secure a uniform result, time was secured on the deliverage of four gallons of fuel oil, and the gallons per minute computed from this figure.

It is believed that a pressure of twenty pounds will be found to be the normal working pressure in actual control work, for though a pressure of 60 pounds may be secured with the Banner pump, as soon as the nozzle is opened it drops very quickly to between 20 and 30 pounds. The rapidity with which the pressure drops depends upon the amount of liquid in the tank, the greater the amount, the more rapidly the pressure will decrease. From the accompanying table it will be seen that a pressure of 20 pounds gives the most efficient results relative to height of stream and gallonage delivered per minute. A six-foot brass pipe extention was used and found to give approximately 5 feet additional height at 20 pounds pressure.

It would seem that there is no need to summarize the table of results as the data are rather self-explanatory. However, there are a few outstanding points which should be mentioned. With the nozzles tested, no improvement over the one developed in 1929 and used during the 1930 season is evident. With each aperture there is a certain pressure which gives maximum results, and any increase in the pressure merely breaks the stream into a spray and reduces the height to which the oil can be thrown. It would seem that to secure a greater height the size of the apexture must

be materially increased, which, of course, will result in a greater wastage of oil. It is possible that a nozzle of the same type as #I, but with a larger apexture, could be used when larger trees are encountered. Such a nozzle with an increased pressure would give a greater height to the oil stream. However, to secure any marked increase in the height to which the oil is thrown, the size of the apexture would need be materially increased, which, of course, would be an oil waster. It would seem that with the oil used the most efficient nozzle has been developed. Perhaps the problem lies as much in the liquid as with the nozzle. The resistance of the air breaks down the viscosity of the oil, and the stream breaks into a spray. Additional pump pressure only serves to increase the breaking down of the stream into a much finer spray.

It is regretted that no improvements in the nozzle as used in 1930 can be recommended as result of these experiments.

Respectfully submitted,

James C. Evenden

James C. Evenden, Entomologist.

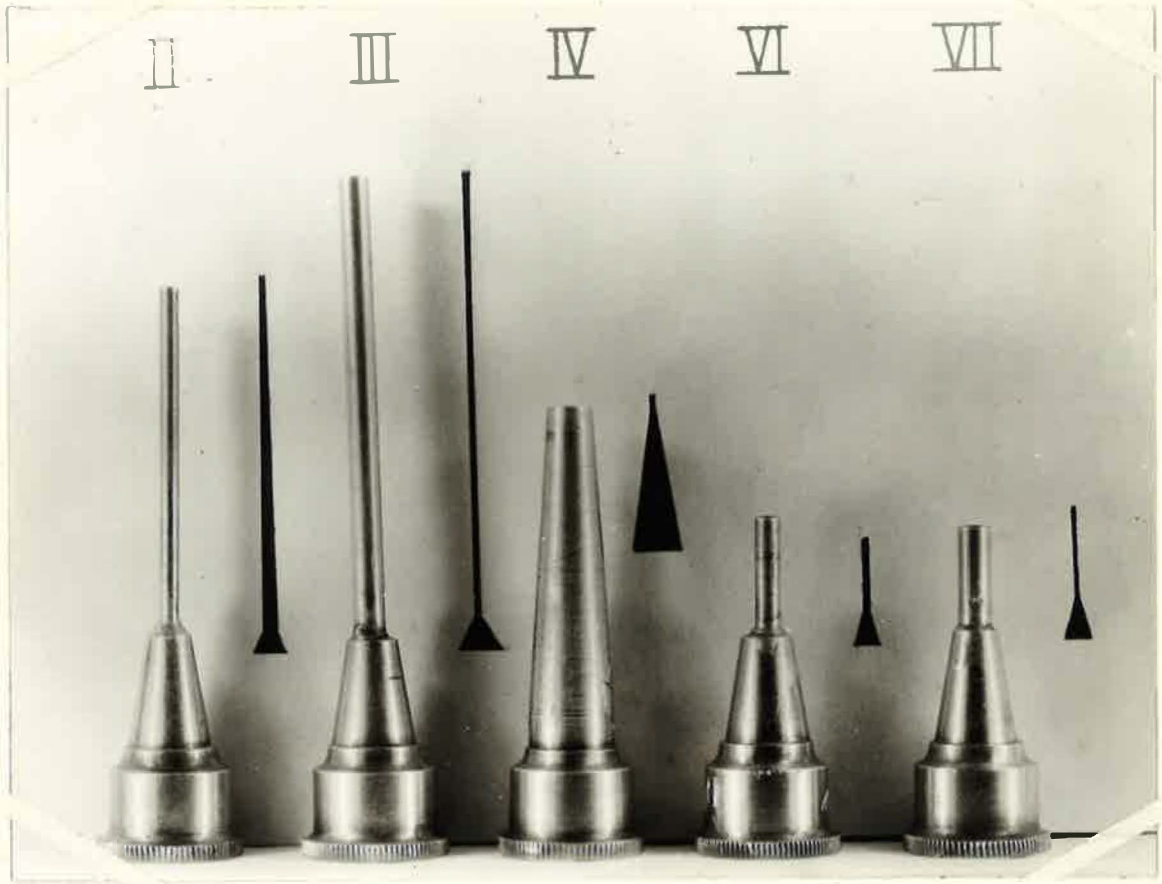
T. T. Terrell

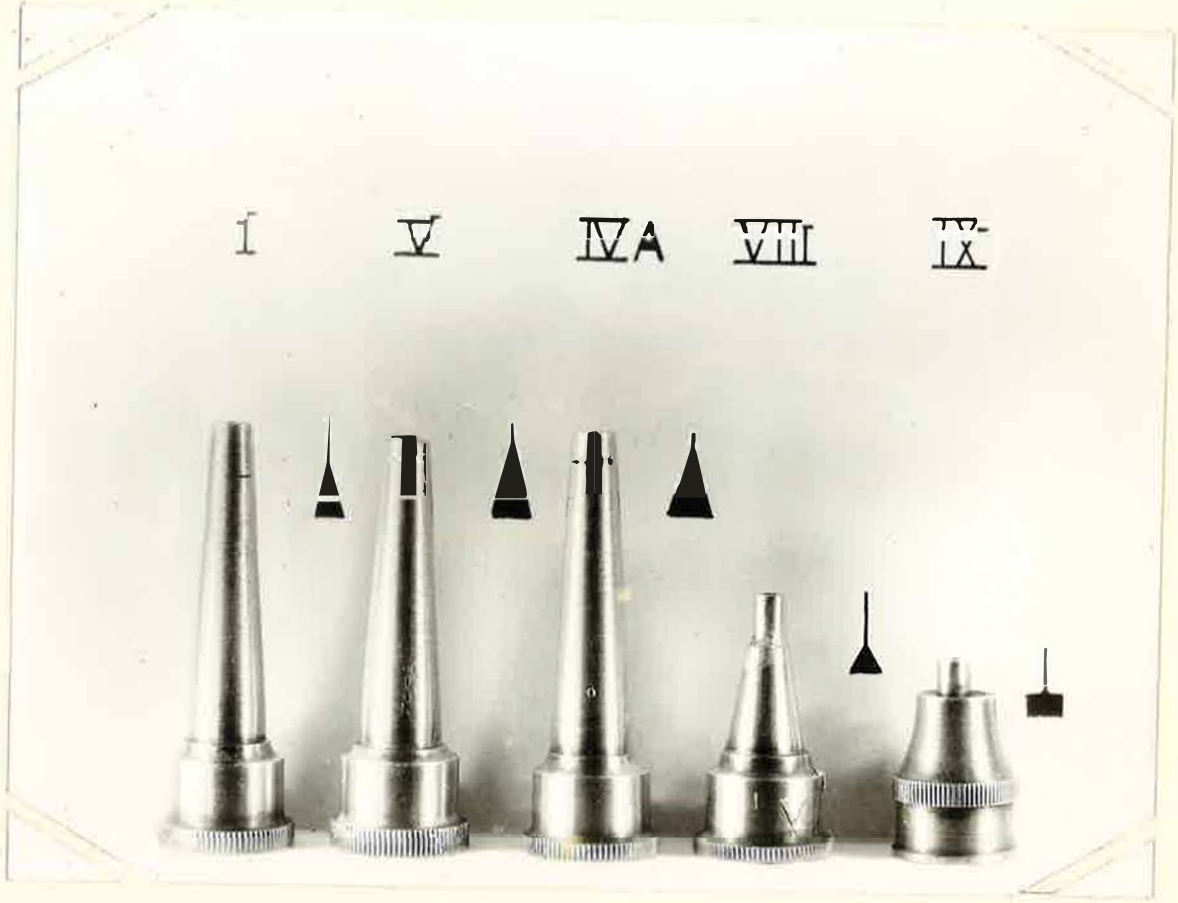
T. T. Terrell, Asst. Scientific Aid

TABLE SHOWING HEIGHT TO WHICH OIL WAS THROWN FROM DIFFERENT NOZZLES AT VARYING PRESSURES, AND THE GALLONS DELIVERED PER MINUTE

Nozzle Number		I	II	III	IV	V	VI	VII	VIII	IX	IVA
	Dia. in Inches:	.053	.056	.060 +	.060-	.057	.065	.079	.084	.086	.061
20 lbs. Pressure	Gallons per Minute	.37	.24	.35		.44	.49	.80	.90	.92	.60
	Height in feet:	21	17	18		20	21.5	21	20.5	19	21
30 lbs. Pressure	Gallons per Minute	.44	.29	.43	.55	.51	.53	.94	1.05	1.09	.69
	Height in feet:	21	18	19	19	21	20	21.5	21	22	22.5
40 lbs. Pressure	Gallons per Minute	.51	.35	.50	.62	.59	.63	1.09	1.16	1.20	.80
	Height in feet:	20	17	18	20	22.5	19.5	22.5	21.5	22	20
50 lbs. Pressure	Gallons per Minute	.57	.42	.58	.72	.66	.70	1.23	1.28	1.33	1.03
	Height in feet:	19	15	16	21.5	21.5	21	21.5	22	22	19

Nozzles tested during this experiment. Photographs show actual size of nozzles, while the black drawings though not drawn to scale as to diameter, show the type and length of bore.


II
III
IV
VI
VII


I
V
IVA
VIII
IX

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY
WASHINGTON, D.C.

D-4
RECEIVED
MAR 21 1931
FOREST MGMT.

Forest Insect Field Station,
Coeur d'Alene, Idaho,
March 19, 1931.

FOREST ENTOMOLOGY
Refer to file
Project F-4

Regional Forester,

Ogden, Utah.

Dear Sir: Attention of Mr. Morse

There is enclosed a report entitled "Experiments Conducted for the Purpose of Developing a More Efficient Nozzle for use in Connection with the Burning-Standing Method of Control."

Your comments, criticisms, or suggestions will be appreciated, and we shall also be glad to answer any questions you may have concerning the experiments.

Respectfully yours,

James C. Evenden

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Entomologist